Genetically Engineered Foods

#9 in a series

U.S. Safety Regulation of Genetically Engineered Crops

A Series from Cornell Cooperative Extension's Genetically Engineered Organisms Public Issues Education (GEO-PIE) Project

IN THE UNITED STATES, THREE DIFFERENT AGENCIES HAVE REGULATORY JURISDICTION OVER GENETICALLY ENGINEERED (GE) ORGANISMS: THE U.S. DEPARTMENT OF AGRICULTURE, THE FOOD AND DRUG ADMINISTRATION, AND THE ENVIRONMENTAL PROTECTION AGENCY.

In 1986, the U.S. government developed its "Coordinated Framework for Regulation of Biotechnology," which outlined how the regulatory responsibilities would be divided among the three agencies, based largely on the existing regulatory framework. The jurisdictions of each agency are described in detail below.

U.S. Department of Agriculture (USDA)

The USDA's Animal and Plant Health Inspection Service (APHIS) is responsible for most issues related to safety of the environmental release of genetically engineered organisms and their impacts on agriculture.

The traditional mandate of APHIS within the U.S. Department of Agriculture has been to monitor and prevent the spread of plant and animal diseases, particularly those of importance to agriculture. Also within the purview of APHIS is the control of weedy "invasive" species (like the Kudzu vines of the southeastern U.S.). APHIS inspects new plants and animals brought into the country, quarantines products that could spread diseases into the U.S., and helps to control the spread of new diseases, invasive plants, animals, and insects. Similarly, APHIS has regulatory jurisdiction over the release of new GE plants and microorganisms into the environment, and eval-uates their potential to become plant pests, weedy "escapes," or otherwise cause damage to U.S. agriculture.

Regulated genetically engineered organisms

In order to move, import, or field test any genetically engineered plants or microorganisms, approval of APHIS must first be acquired by following the guidelines laid out in U.S. Regulation 7 CFR 340. This is similar to the regulations used to monitor the introduction of all other exotic plants and microorganisms into the U.S. Exempt from this regulation are organisms grown in laboratories or in sealed greenhouses (where escape into the environment is unlikely) and genetically engineered organisms which are no longer regulated (see next section). All genetically engineered organisms grown outdoors must pass this step first (regulated field trials are usually a few acres or less).

There are two ways to acquire approval for moving, importing, or field testing GE organisms: notification and release permits.

Notification

The applicant must notify APHIS in writing, and must demonstrate that the GE organism meets certain eligibility criteria and that mechanisms for containment of the GE organisms are adequate. The GE organisms cannot be grown until APHIS receives and formally acknowledges this application. Most new GE plants go through the notification process.

Release Permits

Organisms that do not meet the safety criteria of the notification process (mainly GE microorganisms and pharmaceutical-producing plants) must first be granted a release permit before field-testing. Organisms requiring a permit generally undergo more careful scrutiny and the approval process is more time-consuming.

Notifications and release permits are only valid for one year--the application process must be repeated every year, even if the GE variety is the same. APHIS officials may also conduct inspections of field test sites. Additionally, the developers of regulated GE varieties are required to notify APHIS immediately of any accidents or unintended releases of regulated organisms.

Deregulation of genetically engineered organisms

After the developer of a GE variety has accumulated several years of data from regulated field trials, the developer may petition APHIS to allow the new GE variety to be deregulated. This means that, as far as APHIS is concerned, the deregulated GE variety will be treated no differently than organisms developed by conventional means. Future outdoor plantings, import, and interstate movement no longer require notification or release permits. Deregulation is the first important step in the eventual marketing of a new GE variety in the U.S.-- the new variety must also acquire approval from the FDA and EPA (if necessary) before commercial release.

To petition for deregulated status, the developer of a new GE plant submits all of its available data to address the potential environmental impact and plant pest risk. APHIS requires data to answer the following questions:

- Does the plant exhibit any plant pathogenic properties (i.e., is the plant likely to cause diseases in other plants)?
- Is the plant more likely to become a weed than a non-GE variety?
- Is the plant likely to increase the weediness of other cultivated or wild species it could interbreed with?
- Could the plant cause any damage to processed agricultural commodities?
- Could the plant cause harm to any other organisms (such as bees) that are important to agriculture?

After the final submission of a petition document, APHIS holds a public comment period, reviews the data (and public comments), and then gives its decision. The final decision is usually delivered in the form of two documents: an environmental assessment (EA), which evaluates the potential impact of deregulating the variety, and a decision document, which considers the potential plant pest risk of the GE crop. After a crop variety has been deregulated, it is treated as any other crop variety.

U.S. Food and Drug Administration

If a new GE crop variety will be consumed by humans or animals, the U.S. Food and Drug Administration (FDA) is responsible for evaluation of its food safety.

Regulatory authority of the FDA

The FDA determined in 1986 existing regulations were adequate to regulate new GE foods. Coincident with the development of the first GE food, the FlavrSavr tomato, the FDA published its official interpretation of these regulations in the 1992 "Statement of Policy: Foods Derived from New Plant Varieties." This policy report details the existing food safety regulations and outlines its procedure for the regulation of new GE foods, including several decision-making flowcharts to guide developers through the process.

Most food safety oversight provided by the FDA takes place after the product is on grocery shelves. The FDA, under section 402(a)(1) of the Federal Food, Drug, and Cosmetic Act (FFDC 1938), has the authority to regulate or remove foods from the market which are found to be "adulterated"-- that is, containing an added substance that may render the food harmful. The adulteration concept also applies to deliberate food additives (but see next section). Thus the legal responsibility to ensure the safety of food products or additives falls entirely on the developer of the food. In practice, however, developers generally work closely with the FDA in the development of new foods, to determine whether the FDA would consider a new food adulterated.

Regulation of food additives

Because of public concern for the safety of an increasing number of new food additives, in 1958 the Food Additive Amendment was appended to the FFDC Act, requiring pre-market approval of all food additives. Developers must demonstrate "reasonable certainty of no harm" of a new food additive-- if not, foods containing the additive may be considered adulterated under the original act. The amendment, however, contains an important exception: if an additive is "generally regarded as safe" (GRAS), then the additive is exempt from formal pre-market safety review. The intent of this exception was to prevent common food additives (like salt, pepper, spices, etc) from having to undergo unnecessary safety testing. The determination of GRAS status is not a formal process, and the developer may presume an additive to be GRAS, only to be contradicted later by the FDA.

In the case of GE foods, the FDA has consistently agreed with the developers of the new products that the DNA and proteins "added" to a conventional food by genetic engineering are GRAS. Arguing that DNA and comparable proteins are already widespread in the human diet and present in similar concentrations, the additions to GE foods are therefore not subject to formal pre-market safety review. The FDA maintains, however, that if new GE foods are developed for which GRAS status is unclear-- if, for example, the GE food contains a potential allergen or a novel sweetener-- formal safety reviews may be required.

Food safety issues considered by the FDA

During the consultation process, the FDA advises the developer of a new GE food to consider several important food safety questions. Some of these topics address the question of adulteration (unintended heath consequences), while others may affect the GRAS status of GE "additives."

Safety of new substances

Does the protein product created by the engineered gene raise food safety issues? Are there any other new substances created in the GE food that may render the food harmful? Does the new GE plant contain substances that are not intended for widespread human consumption (in the case of a GE plant that makes pharmaceutical or industrial compounds)?

Nutritional value

Does the new GE food have altered nutritional value (decreased nutrients or increased anti-nutrients) or increased levels of naturally occurring plant toxins?

Allergenicity
Does the introduced GE protein have an increased risk of causing allergic reactions in humans?

Antibiotic markers
Could the use of antibiotic resistance genes as "selection markers" affect human or animal health, by potentially increasing antibiotic resistance in bacteria?

Animal feed issues
Food safety issues might be different for animals than for humans, because animals are often fed diets with a high concentration of a single plant species (corn, for example) and consume plant parts not normally eaten by humans. Could animals be more sensitive to certain food safety risks than humans?

Although not officially stated in FDA guidelines, the FDA uses the idea of "substantial equivalence" when considering the safety and regulatory status of GE foods. If nutritional and toxin content of a new GE food falls within the range of concentrations normally observed in conventional varieties, and if there are no new health risks associated with the added genes and proteins, then the FDA does not regulate GE foods any differently than the conventional food.

Labeling of genetically engineered foods

The FDA requires GE foods to be labeled when there are measurable differences in the nutritional qualities of the product. Foods having decreased nutrient content, increased antinutrient or natural toxin levels, or increased risk of allergenicity must be labeled. The FDA has consistently ruled that they will not require labeling of GE foods simply because they are genetically engineered, in the absence of any observed nutrition or health differences. The FDA has, however, released guidelines for producers wishing to label GE foods voluntarily.

Environmental Protection Agency

Because some GE plants manufacture their own pesticides (*Bt* corn, for example) the U.S. Environmental Protection Agency (EPA) is responsible for the safety of the pesticide levels in those GE plants which produce them.

Regulation of Biopesticides

The EPA under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), requires registration and licensing of all new pesticides. Following EPA guidelines, the pesticide developer must submit data that demonstrate the pesticide will not harm human health or the environment when used as labeled. The data are reviewed by the Office of Pesticide Programs (OPP), and the pesticide may not be marketed until the OPP approves the product's registration.

According to current EPA policy, both novel DNA and proteins genetically engineered into plants with the intent to protect the plant against pests are considered to be "plant incorporated protectants" (PIPs) and are regulated exactly as other pesticides.

This regulation includes the pre-market evaluation of both environmental and food safety impacts. The EPA rather than the FDA is responsible for the food safety of the PIPs in the same way that the EPA evaluates the safety of all other pesticides. Marker genes and other elements not directly related to the pesticidal property are considered "inert ingredients" and also regulated accordingly. DNA itself, although technically classified as a pesticide by EPA legal definitions, is exempt from formal safety review, as all food contains DNA without any indications of health risk.

To date, only two classes of GE plants fall under the EPA purview: plants containing *Bt* toxins (to confer resistance to certain insects) and those expressing resistance to viruses. The EPA regulates the pesticide contained within a GE plant in the same way it regulates a pesticide applied to a plant, but not actually the plant itself.

Part of the confusion lies in the relationship between the EPA and the FDA. The FDA is responsible for food safety, and the EPA is responsible for the safety of the pesticide on human health and the environment. If a plant has been genetically engineered to contain a pesticide (a deliberately toxic compound), the FDA defers to the EPA to evaluate safety of the pesticide. All other aspects of food safety-- such as altered nutritional value, changes in natural toxin levels, etc.-- are still the responsibility of the FDA.

Regulation of Companion Herbicides

The EPA has an additional, indirect role in the regulation of GE varieties. When a GE plant has been engineered to be resistant to a specific "companion" herbicide, this implies that the conventional varieties of the plant are not normally sprayed with the herbicide. The EPA must then consider the health and environmental safety of applying the herbicide to a new crop. If the new application is approved, the EPA must establish new tolerances for residues of the herbicide on the crop, and adjust herbicide labeling to allow the new crop to be sprayed. For example, when GE cotton resistant to the herbicide bromoxynil was first developed, the EPA restricted the application of bromoxynil to only 1 percent of all cotton acres, but this limit has since been increased to 10 percent.

This publication is issued to further Cooperative Extension work mandated by acts of Congress of May 8 and June 20, 1914. It was produced with the cooperation of the U.S. Department of Agriculture; Cornell Cooperative Extension; and College of Agriculture and Life Sciences, College of Human Ecology, and College of Veterinary Medicine at Cornell University. Cornell Cooperative Extension provides equal program and employment opportunities. Helene Dillard, Director.

Alternative formats of this publication are available on request to persons with disabilities who cannot use the printed format. For information call or write the Office of the Director, Cornell Cooperative Extension, 365 Roberts Hall, Ithaca, NY 14853 (605-255-2237).

Additional copies of this publication can be purchased from Cornell University, Media and Technology Services Resource Center, 7 Cornell Business & Technology Park , Ithaca, NY 14850. Phone: 607-255-2080. Fax: 607-255-9946. E-mail: resctr@cornell.edu.

A free catalogue of Cornell Cooperative Extension publications and audiovisuals is available from the same address, or from and Cornell Cooperative Extension office. The catalog can be accessed at www.cce.cornell.edu/publications/catalog.html.

This information is presented with the understanding that no product discrimination is intended and no endorsement of any product mentioned, or criticism of unnamed products is implied.

Produced by Media and Technology Services at Cornell University
www.mediasrv.cornell.edu

399GPFS1 1/03.6M 750/900 ICS MTS10179

If you'd like to learn more about genetic engineering, visit the GEO-PIE Project web site at

www.geo-pie.cornell.edu

CORNELL Cooperative Extension